

CIA/OER/S-07546-75  
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NUCLEAR POWERPLANTS

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EMERGENCY AGENCY  
WASHINGTON, D.C. 20505

10 June 1975

CIA/OER/5-07546-75

MEMORANDUM FOR: Mr. Thomas Clark  
Executive Assistant to the  
Administrative Assistant  
Nuclear Division  
Energy Resource Development Administration.

SUBJECT : Nuclear Powerplants: A Burgeoning  
Market

The attached report you requested estimates the expected magnitude of nuclear power related foreign trade during the next decade. We estimate that such trade will total some \$85 billion between now and 1985, reaching an annual rate of about \$25 billion by 1985 compared to some \$5 billion this year. The US will remain the principle world supplier of nuclear plants and fuels during the period, although its market share will be significantly reduced. If you need any further assistance, I can be reached on 351-7717.

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Chief  
Multilateral Trade Negotiations  
Task Force  
Office of Economic Research

Attachment:  
As stated

Distribution: (S-07546)  
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OER/I/MTN, [redacted]/ka/[redacted] (10 June 1975)

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## NUCLEAR POWERPLANTS: A BURGEONING MARKET

The Arab oil embargo and the jump in petroleum prices have encouraged major industrial countries to accelerate their nuclear energy programs. During the next ten years, this effort is expected to directly generate some \$85 billion in foreign trade in nuclear generating equipment, uranium based fuels and related services. We estimate such trade will reach about \$25 billion in 1985 compared to \$5 billion this year. Although these exports will be equivalent to only about 1% of world trade in 1985, they will likely top such major items in world commerce as wheat and copper.

The United States has been supplying nearly all Free World supplies of nuclear powerplants and uranium enrichment services, but undoubtedly this situation will change. Other developed countries -- particularly in Western Europe -- are stepping up their efforts to produce nuclear plants and fuels. Export competition will intensify, with West Germany and France increasing their market shares at the expense of the United States. Even so, the US will remain the principle world supplier of nuclear plants and fuel through at least 1985.

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## GROWTH OF NUCLEAR GENERATING CAPACITY

During the next ten years, Free World countries are expected to add some 420 gigawatts (GW)\* of nuclear generating capacity, increasing the nuclear power share of total capacity from 5% to 10%-15%. This would mean a seven-fold increase in nuclear generating capacity from its present level -- from about 60 GW to some 480 GW.

The bulk of this new capacity is to be installed in the major industrial countries\*\* (see Table 1). The United States alone will account for nearly half of the increase, while the other developed countries about 45% and the LDCs remaining 5%.

By 1985, West Germany and France are forecast to each have a capacity equal to 25% of the US level, and Japan 15%.

## REACTOR MARKET AND TRADE

The increased capacity requires Free World countries to invest some \$280 billion in nuclear powerplants during the next decade.\*\*\* Three-fourths of this investment is to occur between 1981-85, approaching an annual rate of \$40 billion by 1985.

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\*One GW equals 1,000 megawatts (MW) or 1,000,000 kilowatts (KW).

\*\*US, Canada, Japan, UK, France, Germany, and Italy.

\*\*\*The estimate is based on an average cost of \$500/KW of installed capacity between 1975-80 and \$750/KW between 1981-85.

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About 70% of the projected investment or some \$200 billion could directly enter world trade. This includes \$150 billion for reactors and other machinery and equipment, and \$50 billion for professional services. The balance of investment consists mainly of construction outlays where the bulk of the goods and services would be provided domestically. Some secondary trade in such items as construction and manufacturing materials will be generated, but this trade cannot be quantified.

Actual foreign trade is expected to amount to about 25% of potential trade or some \$50 billion. All major industrial countries are capable of producing and constructing their own nuclear powerplants and, to the maximum extent, will do so. Although these countries have few formal trade restrictions on nuclear plants and equipment, trade in these goods is severely hampered by institutional arrangements. Most nuclear powerplants in Europe and Japan are being built and operated by public or quasi-public organizations who will abide by the government's desire to have most of the work handled by domestic firms. Some foreign trade, nonetheless, will take place among major industrial countries. A few countries, most notably Japan, will be installing larger capacity reactors than they now have the capability to produce and, thus, at

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least initially, will have to import these reactors. As the industry develops, foreign trade will also be spurred by increasing international specialization in components. But offsetting this trend will be the increasing ability of each country to produce the needed equipment domestically. On balance, we expect that trade among the major developed countries will probably reach \$15 billion during the next decade.

Unlike the major industrial countries, where less than one-fifth of capital investment is expected to generate trade, the bulk of such investment by other Free World countries will likely be traded. This estimate assumes that Sweden, Switzerland, and Belgium will produce their own equipment, while the other countries will import theirs. With the exception of some LDCs, these countries are expected to provide most of the labor and materials needed to construct site facilities. Thus, \$20 billion of the \$30 billion in nuclear investment will enter foreign trade.

Besides trade in nuclear plant and equipment, we estimate that some \$15 billion trade in services will be generated during the next decade. The bulk of this trade will consist of engineering and supervisory services provided by the major industrial countries to other Free World countries. Included in the estimate are royalty

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payments of from \$1 billion to \$2 billion for the production of nuclear reactors under license.

### NUCLEAR FUEL CYCLE MARKET AND TRADE

Based on the forecast of nuclear generating capacity, Free World countries are expected to spend \$60 billion for procurement of fuel cycle services through 1985. Uranium enrichment services would account for \$30 billion of these outlays, the procurement of natural uranium \$24 billion, and other fuel cycle activities for \$6 billion.\* Trade in all nuclear fuel cycle activities will likely total some \$35 billion over the next ten years, increasing from the 1975 level of nearly \$2 billion to about \$10 billion by 1985.

The US now has a near monopoly in producing and supplying enrichment services to the West. By 1985, the US is expected to almost triple its enrichment capacity, but still the rush to diversify sources of supply and the obvious need for additional capacity will cut the US share of Western capacity to about three quarters of the total in 1980 and 60% in 1985. The remaining portion will mostly be centered in Western Europe. As a result, while nuclear generating capacity and construction capabilities are

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\*Other activities include conversion of natural uranium to enrichment plant feed material, reconversion and fabrication of nuclear fuel, spent fuel shipping and reprocessing, waste disposal, and credit for the value of plutonium generation in power reactors.

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rapidly spreading, trade in enrichment services will be necessary for the foreseeable future. Over the next decade, enrichment service trade is projected to be about \$20 billion.

Trade in natural uranium will also be brisk, not only to supply nuclear power plants fueled with natural uranium, but also to supply the uranium feed required for those using enriched uranium. Trade in natural uranium and fuel cycle activities other than enrichment over the next ten years will total about \$15 billion.

### MARKET COMPETITION

A decade ago, the United States held a virtual monopoly in supplying equipment and technology for nuclear powerplants in the West. Technology transfers (mainly through licensing agreements) coupled with intensified R & D programs abroad has enabled nine other Free World countries to be now capable of producing and exporting components for nuclear powerplants. By the early to mid-1980s, major EC countries also will be able to supply uranium enrichment services through multinational organizations.

Despite growing competition, the United States should remain the largest Free World exporter of nuclear plants and fuel over the next decade.-- although its market share will be significantly reduced. West Germany, Sweden, and France will be the primary US competitors for the sale

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of enriched uranium reactors (light-water reactors). West Germany and France are already nearing settlement on the sale of turnkey nuclear powerplants to Brazil and Iran respectively. If concluded, these two agreements alone could generate some \$6 billion in export trade. Other producers will also secure trade, but they are not expected to be major competitors in the market, at least not through 1985. Future sales of plants using natural uranium will almost certainly go to Canada; the only major producer continuing to develop this type of reactor.

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TABLE 1

## FREE WORLD COUNTRIES: NUCLEAR GENERATING CAPACITY AND INVESTMENT

	(installed GW at end of year)			(billion US \$)		
	1974	1980	1985	1975-80	1981-85	1975-85
<b>TOTAL</b>	58	208	477	77	202	279
<b>Major Developed Countries</b>	51	170	384	61	160	221
United States	33	92	206	30	86	116
Canada	3	7	17	2	7	9
Japan	4	17	30	7	10	17
West Germany	2	19	45	9	19	28
France	3	19	50	8	23	31
United Kingdom	5	12	16	3	3	6
Italy	1	4	20	2	12	14
<b>Other Developed Countries</b>	6	27	68	11	31	42
<b>Less Developed Countries</b>	1	10	25	5	11	16

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TABLE 2  
ESTIMATED ANNUAL ENRICHMENT CAPACITY  
AVAILABLE IN FREE WORLD COUNTRIES

(Million Separative Work Units)

<u>Source</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>
TOTAL	15.4	35.3	66.5
United States	14.2 <sup>1</sup>	25.4 <sup>1</sup>	39.7 <sup>2</sup>
URENCO	...	2.0	10.0
Eurodif	...	6.5	10.7
Capenhurst (United Kingdom)	0.4	0.4	0.4
Pierrelatte (France)	0.7	0.7	0.7
South Africa	0.15	0.3	5.0

1. Excluding US preproduction stocks. Such stocks amounted to 16.6 million SWU on 1 July 1973.
2. This assumes a fourth gaseous diffusion plant of about 9 million SWU and a gas centrifuge plant of about 3 million SWU will be constructed in the US by 1985.

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